Washington State Department of Transportation

Load Capacity Calculation for Timber Stringers

Agency	Calculated By
Bridge Number	Checked By
Bridge Name	Date

Necessary Information

Stringers: Base (Inches) _____ Height (Inches) _____

Butt (Inches) _____ Tip (Inches) _____

Material: Douglas Fir _____ Cedar _____ Hem Fir _____

Grade: Select Struct. _____ No. 1 _____

No. of Lines of Stringers _____ Typical Spacing Ctr. to Ctr. (Feet) _____

Max Span Length Ctr. to Ctr. of Bearings (Feet) _____

Deck: Type _____ Thickness (Inches) _____ , Roadway Width (Feet) _____

Surfacing: Type _____ Thickness (Inches) _____

Describe Stringer Section Loss: _____

Calculations Per Individual Stringer

Dead Load:

Stringers: H (Inches) _____ x B (Inches) _____ x 0.35

Ave. D (Inches) (_____)^2 x 0.27 = _____ lb./ft.

Deck: Timber Thickness _____ (inches) x 4.17

Concrete Thickness _____ (inches) x 12.50

Corrugated Steel: (Factor includes wt. of asphalt to top of corrugations)

Gage	Thickness	Factor
7	.179	21.2
10	.135	18.5
12	.105	16.7

x _____ / Stringer Spacing (ft.) = _____ lb./ft.

Surfacing: (Bituminous) Thickness _____ (inches) x 11.67

(Gravel) Thickness _____ (inches) x 9.17

x _____ / Stringer Spacing (ft.) = _____ lb./ft.

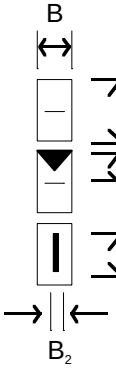
Total DeadLoad _____ lb./ft.

Dead Load Moment: (_____ Total D.L. (lb./ft.)) x (_____ Span Length (ft.))^2 x 0.000125 = _____ K-ft.

Stringer Capacity:

Section Modulus _____ = _____ in.^{3}

Choose Formula From Below
(All dimensions in inches)



Solid Rectangular; $\frac{BH^2}{6}$

H_1 Top rot above Neutral Axis (N.A.); Approx. $\frac{B\left(H - \frac{H_1}{3}\right)^2}{6}$

H_2 Center rot symmetrical about N.A.; $\frac{BH^3 - B_2H_2^3}{6H}$

Solid Circular; Approx. $\frac{D^3}{10}$

Center rot symmetrical about N.A.; Approx. $\frac{D^4 - D_1^4}{10D}$

Calculations Per Individual Stringer - Continued

Allowable Stress:
(Choose value from table below)

For Inventory Rating = _____

For Operating Rating = _____

	Douglas Fir		Cedar		Hem Fir	
	Select Structure	No. 1	Select Structure	No. 1	Select Structure	No. 1
Inventory	1.60 ksi	1.35 ksi	1.10 ksi	0.95 ksi	1.30 ksi	1.05 ksi
Operating	2.13 ksi	1.80 ksi	1.46 ksi	1.25 ksi	1.73 ksi	1.40 ksi

Available for Live Load:
(Calculate as shown below)

For Inventory Rating = _____

For Operating Rating = _____

Inventory Calculation	Operating Calculation
_____ x _____ x 0.083 = _____ (Inv. Stress) (Sec. Mod.)	_____ x _____ x 0.083 = _____ (Oper. Stress) (Sec. Mod.)
Subtract Dead Load Moment - _____	Subtract Dead Load Moment - _____
Available for Live Load = _____	Available for Live Load = _____

Calculations for Bridge as a Unit:

Distribution Factor:
(Calculate from table below)

For Inventory Rating
And Operating Rating = _____

Kind of Floor	For Bridge Roadway ≤ 18 ft.	For Bridge Roadway > 18 ft.
Timber: Plank [1]	S/4.0	S/3.75
Timber: Strip 4 In. (101.6 mm) thick or multiple layer floors over 5 in. (127 mm) thick	S/4.5	S/4.0
Timber: Strip 6 In. (152.4 mm) or more thick	S/5.0 If S exceeds 5 ft. use footnote [2]	S/4.25 If S exceeds 5 ft. use footnote [2]
Concrete: On Timber Stringers	S/6.0 If S exceeds 5 ft. use footnote [2]	S/5.0 If S exceeds 5 ft. use footnote [2]
Corregated Steel: 7 gage 10 gage 12 gage	 S/4.0 S/3.85 S/3.75	 S/3.75 S/3.65 S/3.55

S = Average stringer spacing in feet.

1 = Splined and dowelled timber flooring shall have the same distribution as strip floors of equivalent thickness.

2 = In this case, the load on each stringer shall be the reaction of the wheel loads, assuming the flooring between the stringers to act as a simple beam.

Calculations for Bridge as a Unit - Continued

Allowable Moment per Line of Wheels
(Calculate as shown below)

For Inventory Rating = _____

For Operating Rating = _____

Inventory Calculation	Operating Calculation
_____ / _____ = _____ (Available for Live Load for Inventory) (Dist. Fac.) (Allowable Moment)	_____ / _____ = _____ (Available for Live Load for Opertating) (Dist. Fac.) (Allowable Moment)

Load Ratings

Safe Load Capacity:
(Calculate for each truck as shown at right)

For Inventory Rating = $\frac{\text{Calculated allowable moment per line of wheels for inventory}}{\text{Live load moment per line of wheels (from table on following page)}}$

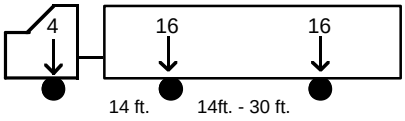
For Operating Rating = $\frac{\text{Calculated allowable moment per line of wheels for operating}}{\text{Live load moment per line of wheels (from table on following page)}}$

Purpose	Truck	Inventory Calculation	Operating Calculation
Inventory Coding Data	HS-20	____ x 36 = _____ (Tons)	____ x 36 = _____ (Tons)
Safe Load Carrying Capacity (Bridge Posting)	Type 3	____ x 25 = _____ (Tons)	____ x 25 = _____ (Tons)
	Type 3S2	____ x 36 = _____ (Tons)	____ x 36 = _____ (Tons)
	Type 3-3	____ x 40 = _____ (Tons)	____ x 40 = _____ (Tons)
Special Permits	Overload 1	____ x 48 = _____ (Tons)	____ x 48 = _____ (Tons)
	Overload 2	____ x 103.5= _____ (Tons)	____ x 103.5= _____ (Tons)

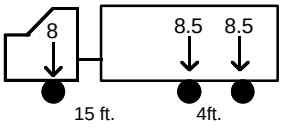
Live Load Moment Per Line of Wheels
(Values shown are in kip-feet without impact)

Type of Loading						Span (In ft. from center to center of bearing)
HS-20	Type 3	Type 3S2	Type 3-3	OL1	OL2	
40.0	27.2	24.8	22.4	32.3	27.2	10
44.0	31.3	28.5	25.8	37.7	35.3	11
48.0	35.4	32.2	29.1	43.0	43.4	11
52.0	39.4	36.0	32.5	48.4	51.5	13
56.0	43.5	39.7	35.8	53.8	59.6	14
60.0	47.6	43.4	39.2	59.2	67.6	15
64.0	51.7	47.1	42.6	64.5	75.8	16
68.0	55.8	50.8	45.9	69.9	83.9	17
72.0	59.8	54.6	49.3	75.3	92.0	18
76.0	63.9	58.3	52.6	80.1	100.1	19
80.0	68.0	62.0	56.0	86.0	108.2	20
88.0	76.5	69.8	63.0	99.3	124.5	22
96.4	85.0	80.0	70.0	112.5	140.7	24
111.1	93.5	90.2	77.0	125.8	156.9	26
126.0	102.0	100.5	84.0	142.3	173.9	28
141.1	111.6	110.7	91.0	162.9	193.1	30
156.3	123.6	121.0	101.0	183.6	212.3	32
171.8	135.6	131.2	111.5	206.4	231.5	34
189.5	148.0	141.5	122.1	230.1	250.7	36
207.2	160.5	151.7	132.6	253.9	269.9	38
224.9	173.0	162.0	143.2	277.6	290.0	40
269.4	204.3	190.8	170.1	337.1	369.9	45
314.0	235.5	219.6	197.0	396.7	449.4	50
358.6	266.8	262.8	239.5	456.4	529.2	55
403.3	298.0	306.0	282.0	516.1	609.2	60
448.0	329.3	349.2	326.0	575.9	717.4	65
492.8	360.5	392.4	370.0	635.7	839.3	70
537.6	391.8	436.7	420.0	695.5	961.2	75
582.5	423.0	481.0	470.0	755.3	1083.0	80
627.4	454.3	526.0	520.0	815.2	1209.1	85
672.2	485.5	571.0	570.0	875.1	1388.7	90
717.1	516.8	616.0	620.0	935.0	1468.2	95
762.0	548.0	661.0	670.0	995.0	1597.5	100
851.8	610.5	751.3	770.0	1114.5	1856.5	110
941.7	673.0	841.6	870.0	1234.5	2115.5	120
1031.6	735.5	931.3	970.0	1354.5	2374.5	130
1121.4	798.0	1021.0	1070.0	1474.5	2633.5	140
1237.6	860.5	1111.0	1170.0	1594.0	2892.5	150
1384.0	923.0	1201.0	1270.0	1714.0	3151.5	160
1538.6	985.5	1291.0	1370.0	1834.0	3410.0	170

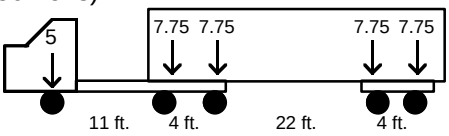
HS-20 (36 Tons)



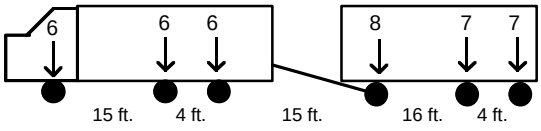
Type 3 (25 Tons)



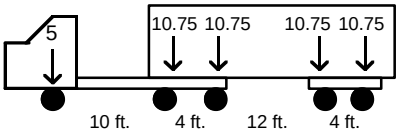
Type 3S2 (36 Tons)



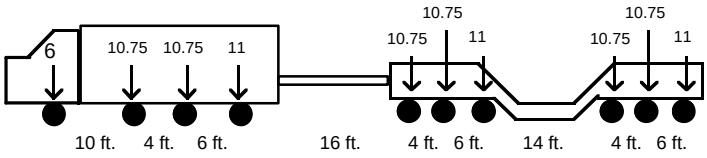
Type 3-3 (40 Tons)



Overload 1 (48 Tons)



Overload 2 (103.5 Tons)



All weights shown are in tons per axle or kips per wheel line.